Nov. 26, 1935. L. P. F. VAN DER GRINTEN 2,022,014

METHOD FOR MAKING REFLEX COPIES

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Fig. 1.

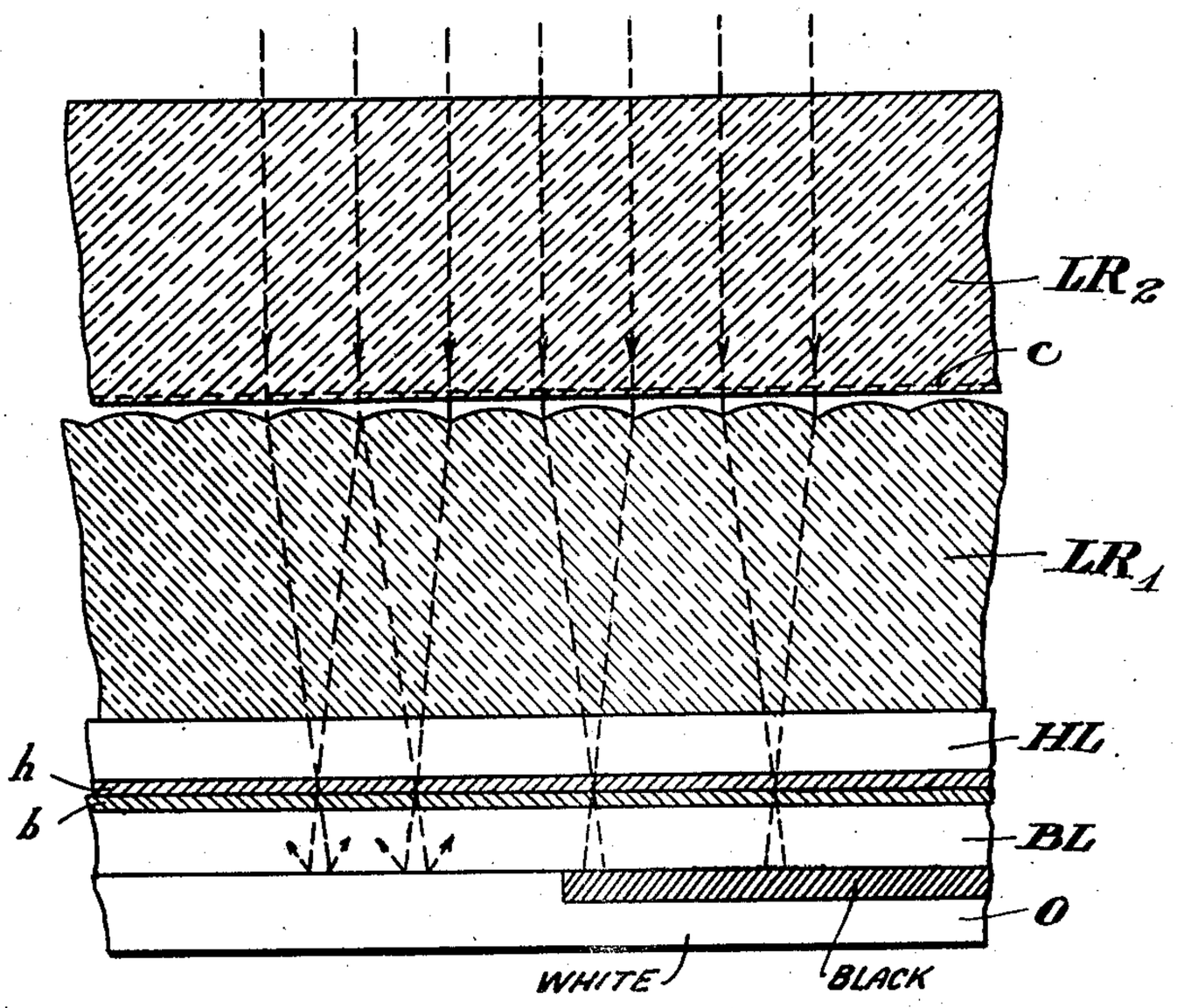
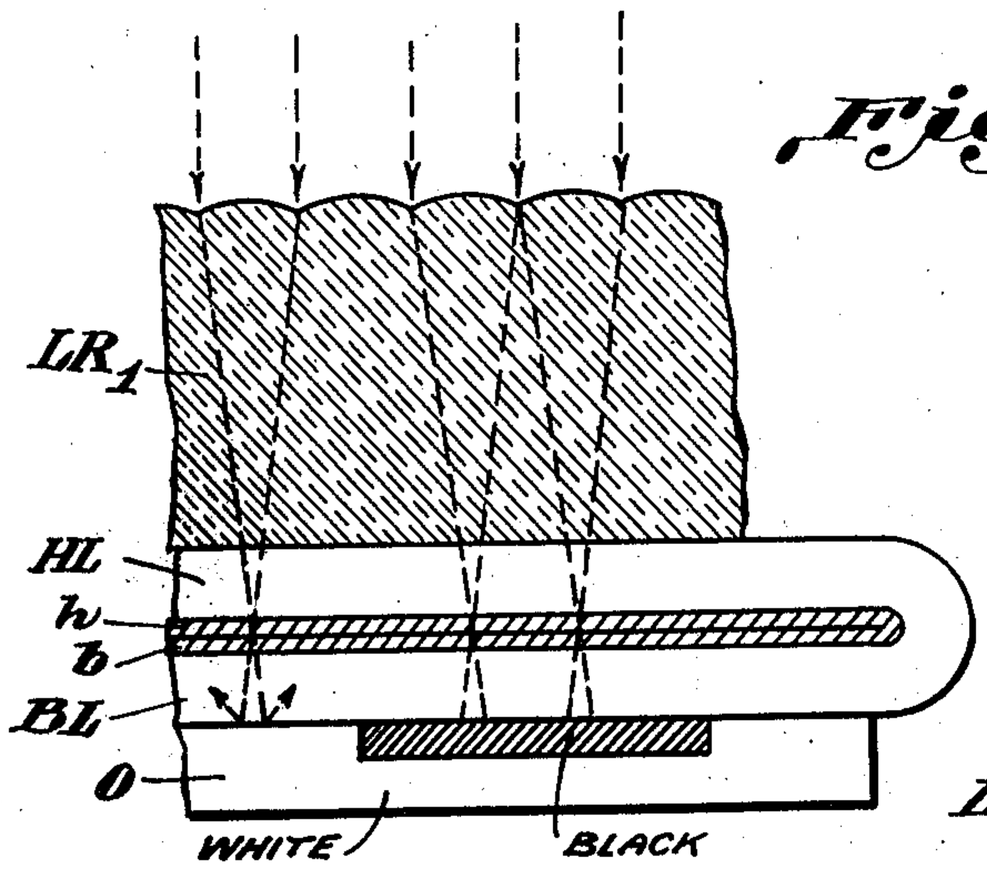


Fig. 2.



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METHOD FOR MAKING REFLEX COPIES

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12 Claims. (Cl. 95—5)

It is known to make reflex copies by a method comprising the steps of applying on an original a sheet containing a layer of sensitive material subjecting the original to a radiation through said sheet and subdividing said radiation before it has passed through the layer of sensitive material into small areas of lower and higher photochemical power.

Now it has been found that the strength of the picture can be increased by methods to be further described, whilst the type of the rays employed may be also of importance.

If one compares with the help of the microscope those parts of the reflexion copy that were during the production of the latter over the dark regions of the original, with the employed subdivision into regions of greater and of smaller actinic intensity, consequently for example with the employed screening, there will be found in many cases that a considerable action on the sensitive layer in the portions of smaller photochemical action has occurred. The result of this action is hereinafter called the "halo"; it may for example be practically expressed by the reduction of the covering factor of the screening of the portions in question (the covering factor being the surface of the regions of smaller photochemical action, or the corresponding regions in the reflexion copy, per unit of surface).

Now it has been found that the halo exerts an unexpectedly large injurious influence on the strength of the picture. The object of the present invention is therefore "to limit this halo". Wherever hereinafter reference is made to rays, or to transparency, or to capacity of reflexion therefore, this always means that reference is made to rays of such wave length as influence photochemically the sensitive layer or layers employed.

The requirements necessary for the practical avoidance of a halo in the sensitive layer are dependent on many different factors, likewise the importance of the halo itself. They are determined inter alia by the kind and the coarseness of the subdivision into regions of greater and of smaller actinic intensity, which has been employed by the picture- or image-distance (the image distance is the distance in mm. between the layer in which the picture is produced and the original) in relation thereto, by the nature of the original, and the like. The present invention, however, is not concerned with these factors but relates to methods of limiting the halo caused by an imperfect subdivision into regions of greater and smaller actinic intensity.

According to the invention this is effected by applying between the screen, used for subdividing the radiation, and the sensitive layer in which the image has to be formed by the rays reflected by the original, one or more auxiliary layers of a sensitive material having a small transparency for the rays used, but becoming more transparent by radiation.

The invention is illustrated by the accompanying drawing, wherein

Figure 1 shows a system embodying the original, sensitive sheet, auxiliary layer, and a double cylindrical lens screen.

Figure 2 shows the system embodying the original, a double fold sheet having one side functioning as an auxiliary layer and the other a picture producing layer, and a single cylindrical lens screen.

In this drawing 0 is the original which is covered by a transparent carrier BL carrying the image forming layer *b*. HL is another transparent carrier carrying the auxiliary sensitive layer *h*. The carrier HL is covered by the cylindrical lens screen LR1, which may or may not be covered with another lens screen LR2. The axes of the lenses should cross one another at wide angles but this is not shown on the drawing for clearness' sake. As shown the focal lines of both lens systems are located in one of the sensitive layers. A radiation impinging upon the lens screen LR2 or directly on LR1 is condensed into small beams of rays, separated by areas in which only a diffused radiation takes place. The concentrated beams decompose the sensitive material first in the auxiliary layer *h*, then in the picture producing layer *b*, strike the original and are reflected by the light parts of the original, the reflected rays forming the picture in the picture producing layer *b*. The diffused radiation between the concentrated beams strikes the auxiliary layer which is decomposed by it. As, however, the intensity of this diffused radiation is much less than the intensity in the concentrated beams, it requires a considerable time before the auxiliary layer has been completely

decomposed. As long as the auxiliary layer is not decomposed it is not transparent, so that it protects for a considerable time the underlying picture producing layer. During this time the reflex copy is formed because the penetration of the two layers by the concentrated beams requires only a very short time. The time of protection afforded by the auxiliary layer should be sufficient to enable the reflexion copy to be formed without the possibility of any substantial action of the diffused rays on the picture producing layer in the portions of smaller photochemical activity.

In this manner it has been found possible to avoid a halo even in the case of a very imperfect subdivision of the radiation.

By the picture producing layer is meant one that is adapted to form the picture by means of any treatment whatever after the termination of the radiation.

By the auxiliary layer is meant one which does not take part in the picture production and which permits the rays that affect photochemically the picture producing layer to pass through after sufficient radiation and less before such radiation.

During the production of the reflexion copy the picture producing layer must of course be located between the auxiliary layer and the original. The greater the difference in transparency of the auxiliary layer before and after radiation, the more the halo is diminished. In the case of an auxiliary layer that contains a given sensitive material the halo diminishes with the quantity of radiation necessary to decompose the auxiliary layer. (Sensitivity of the layer.) To avoid an unduly long exposure and still obtain a reflex copy with a considerably reduced halo, it is desirable to use an auxiliary layer of a sensitivity such that after the production of the reflexion copy the auxiliary layer still exhibits a subdivision into regions of greater and of smaller transparency with a covering factor that corresponds to the subdivision employed and which appears after radiation. The above indicated limit of the sensitivity of the auxiliary layer is lower as the sensitivity of the picture producing layer decreases, and/or as the capacity for reflexion of the original decreases, and/or as the imperfections and/or the covering factor of the division increase.

Advantageously the distance or space between the auxiliary layer and the picture producing layer is made as small as possible.

In many cases the auxiliary layer and the picture producing layer will be contained in separate sheets. They may also be present together in the same sheet, from which then the auxiliary layer may be removed as far as necessary for example by washing, exposure and so on. This, for example, a cyano-type- or blue-print layer naturally has an auxiliary layer, which circumstance renders the blue-print layer specially suitable in the sense of the present invention for reflectography with subdivision into regions of greater and of smaller actinic intensity. The auxiliary layer and the picture producing layer may even form together one layer, in which case after a sufficient exposure to obtain a reflexion copy the part of the layer acting as auxiliary layer is bleached away by a short exposure to undivided radiation.

While lens screens have the advantage of subdividing a radiation into regions of smaller and greater photochemical activity in an economical way they have, however, certain imperfections which may be counteracted by combining them with covering screens. But these combinations in practice are often times difficult to realize, especially when two crossed lens screens have to be combined with a covering screen. When lens screens and especially crossed lens screens are used and an auxiliary layer is interposed between them and the picture forming layer then these imperfections are counteracted effectively without the practical difficulties of the lens screen-covering screen combinations.

If it is desired to use in the picture producing layer a sensitive material the transparency of which is increased considerably by radiation, for example a diazotype-process layer, the same material may be used also for the auxiliary layer. A practical mode of carrying this out is the employment of a folded double sheet of this sensitive material. The sheet turned towards the screen then serves as the auxiliary layer and that turned towards the original serves as the picture-producing layer.

The use of the same sensitive material in the auxiliary layer as in the picture producing layer presents the advantage that the auxiliary layer will, as regards radiation, be less transparent exactly for those rays which exert photochemical action on the picture producing layer.

Example 1

On an original O (see Figure 1) there is placed a sensitive sheet (BL) with the side on which is the sensitive cyanotype-layer (*b*) turned away from the original. On this sensitive sheet there is placed a unilaterally saponified sensitive acetylcellulose sheet (HL) 0.1 mm. in thickness, which is coated on its saponified side with p-diazodiethylaniline and the coated side (*h*) is turned towards the original.

The first named sheet (BL) is intended for the picture production, while the second (HL) serves as an auxiliary layer. This auxiliary layer has before radiation a small transparency, which is increased by the radiation.

On this system there is placed a cylindrical lens screen (LR1) in a celluloid foil of 0.4 mm., the lenses of which have a focal length of 0.5 mm. whilst the distance of the focal lines between each other is 0.12 mm. The lenses are turned away from the original. Another cylindrical lens screen (LR2) is placed thereon with its lenses turned towards the original so that the axes of the two screens cross one another.

In Figure 1 the lenses in (LR2) cannot be shown because their axes are parallel to the plane of the drawing; the dotted line *c* indicates the depth of the limit between two lenses. The lenses of (LR1) make the pencils of rays emerging from (LR2) to converge in a plane perpendicular to the plane of the drawing the focus of the lenses being in a plane within one of the sensitive layers. The rays are thus focused in two directions crossing each other which makes them to converge into pointlike focuses located in a plane within one of the sensitive layers.

The entire system is well pressed together in a pressing frame so that adequate contact is obtained between original sensitive sheets and screen. The radiation is effected by means of a punctiform arc lamp located at a distance of 40 cm. from the system. The radiation passes in sequence through the lens screens LR2 and LR1, the auxiliary layer *h* and the picture-producing layer *b*, and then impinges upon the original O. The sensitivity of the auxiliary layer is made such that after exposure a screen structure appears

thereon on miscroscopic examination: For the purpose of making this screening more visible there is employed a blue filter or the auxiliary layer is developed.

The picture producing layer is fixed by immersion in a dilute potassium ferric cyanide solution and in water. There is obtained a negative reflexion copy which is stronger than would be obtained in a similar process but without an auxiliary layer. As a matter of fact the transparent portions show on microscopic observation a star-shaped halo, located about the foci of the crossed cylindrical lens system but to a smaller degree than would have been the case without the employment of the auxiliary layer.

As is known, blue-print layers lose their surface layer on fixing by washing with water. In this way a blue print layer so to speak always carries its auxiliary layer with it and it loses it on fixing. This auxiliary layer, however, only has a relatively small effect. The action of the above described extra auxiliary layer is considerably greater. In general, the surroundings of the arc lamp will reflect a small quantity of light. This can be prevented by blacking these surroundings in which case a somewhat more sensitive auxiliary layer may be chosen.

Example 2

In the system described in Example 1, for the auxiliary layer and the picture-producing layer there is substituted a double-fold sheet which is coated on one side with diazoethylbenzylaniline, in not too great strength, whilst the coated sides are in contact with each other. There is employed only a single cylindrical lens screen. (Compare Figure 2.) One side of the sheet functions as an auxiliary layer and the other as a picture producing layer. After exposure and development the latter shows actually a much smaller halo than would be the case if a clear photochemically inactive intermediate layer had been substituted for the auxiliary layer.

What I claim is:—

1. A method for making reflex copies comprising applying on an original a sheet containing a picture producing layer of sensitive material, superimposing on said picture producing layer an auxiliary layer of sensitive material, which is initially substantially non-transparent to the rays subsequently used in making of the reflex copies but becomes transparent to such rays after having been acted upon by a sufficient amount of radiation by such rays, subdividing a radiation into small regions of lower and higher photochemical activity, and causing said sub-divided radiation to pass through both of said layers on its way to the original.

2. Method according to claim 1 in which the auxiliary layer used is such that the difference in transparency before and after radiation is great.

3. A method for making reflex copies comprising applying on an original a sheet containing a picture producing layer of sensitive material, superimposing on said picture producing layer an auxiliary layer of sensitive material, which is initially substantially non-transparent to the rays subsequently used in making of the reflex copies but becomes transparent to such rays after having been acted upon by a sufficient amount of radiation by such rays, causing a radiation to pass through a lens screen to subdivide said radiation into small regions of lower and higher photochemical activity, and causing said subdivided radiation to pass through both of said layers on its way to the original.

4. Method according to claim 1, in which the auxiliary layer is a part of the sheet containing the picture producing layer.

5. Method according to claim 1 in which the picture producing layer and the auxiliary layer are so arranged that there is practically no space between them.

6. Method according to claim 1 in which the auxiliary layer used is one which has such sensitivity to radiation that after the exposure required to make the reflex copy on the picture producing layer it is subdivided into regions of greater and smaller transparency.

7. A method for making reflex copies comprising applying on an original a sheet containing a picture producing layer of sensitive material, superimposing on said picture producing layer an auxiliary layer containing the same sensitive material as that of said picture producing layer, said auxiliary layer being initially substantially non-transparent to the rays subsequently used in making of the reflex copies but becoming transparent to such rays after having been acted upon by a sufficient amount of radiation by such rays, subdividing a radiation into small regions of lower and higher photochemical activity, and causing said subdivided radiation to pass through both of said layers on its way to the original.

8. A method for making reflex copies comprising selecting a sheet containing a picture producing layer of sensitive material which material is initially substantially non-transparent to the rays subsequently used in making the reflex copies but becomes transparent to such rays after having been acted upon by a sufficient amount of radiation by such rays, folding said sheet in such manner as to form two layers in contact with each other, applying said folded sheet on an original, subdividing a radiation into small regions of lower and higher photochemical activity and causing said subdived radiation to pass through both of said layers on its way to the original.

9. The method according to claim 1 in which the auxiliary layer and the picture producing layer are combined in one layer.

10. A method for making reflex copies comprising applying on an original a sheet containing a picture producing layer of sensitive material, superimposing on said picture producing layer an auxiliary layer of a sensitive diazo compound, said auxiliary layer being initially substantially non-transparent to the rays subsequently used in making of the reflex copies but becoming transparent to such rays after having been acted upon by a sufficient amount of radiation by such rays, subdividing a radiation into small regions of lower and higher photochemical activity, and causing said subdivided radiation to pass through both of said layers on its way to the original.

11. A method for making reflex copies comprising applying on an original a sheet containing a picture producing layer of sensitive material, superimposing on said picture producing layer an auxiliary layer of a sensitive cyanotype composition, said auxiliary layer being initially substantially non-transparent to the rays subsequently used in making of the reflex copies but becoming transparent to such rays after having been acted upon by a sufficient amount of radiation by such rays, subdividing a radiation into small regions of lower and higher photochemical activity, and causing said subdivided radiation to pass through both of said layers on its way to the original.

12. A method for making reflex copies comprising applying on an original a sheet containing a picture producing layer of sensitive material, superimposing on said picture producing layer an auxiliary layer of a sensitive and bleaching chromate composition, said auxiliary layer being initially substantially non-transparent to the rays subsequently used in making of the reflex copies but becoming transparent to such rays after having been acted upon by a sufficient amount of radiation by such rays, subdividing a radiation into small regions of lower and higher photochemical activity, and causing said subdivided radiation to pass through both of said layers on its way to the original.

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